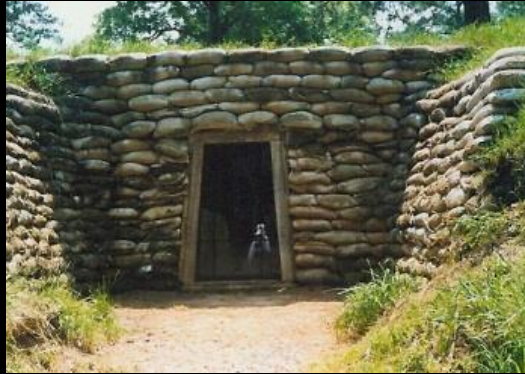




# Climate Change Response and Cultural Landscapes



Presentation with notes by John Hammond, Historical Landscape Architect



[Speaker notes]

When climate change first emerged as a growing environmental crisis, it was viewed as primarily a natural resource issue – the realm of polar bears and ice caps...





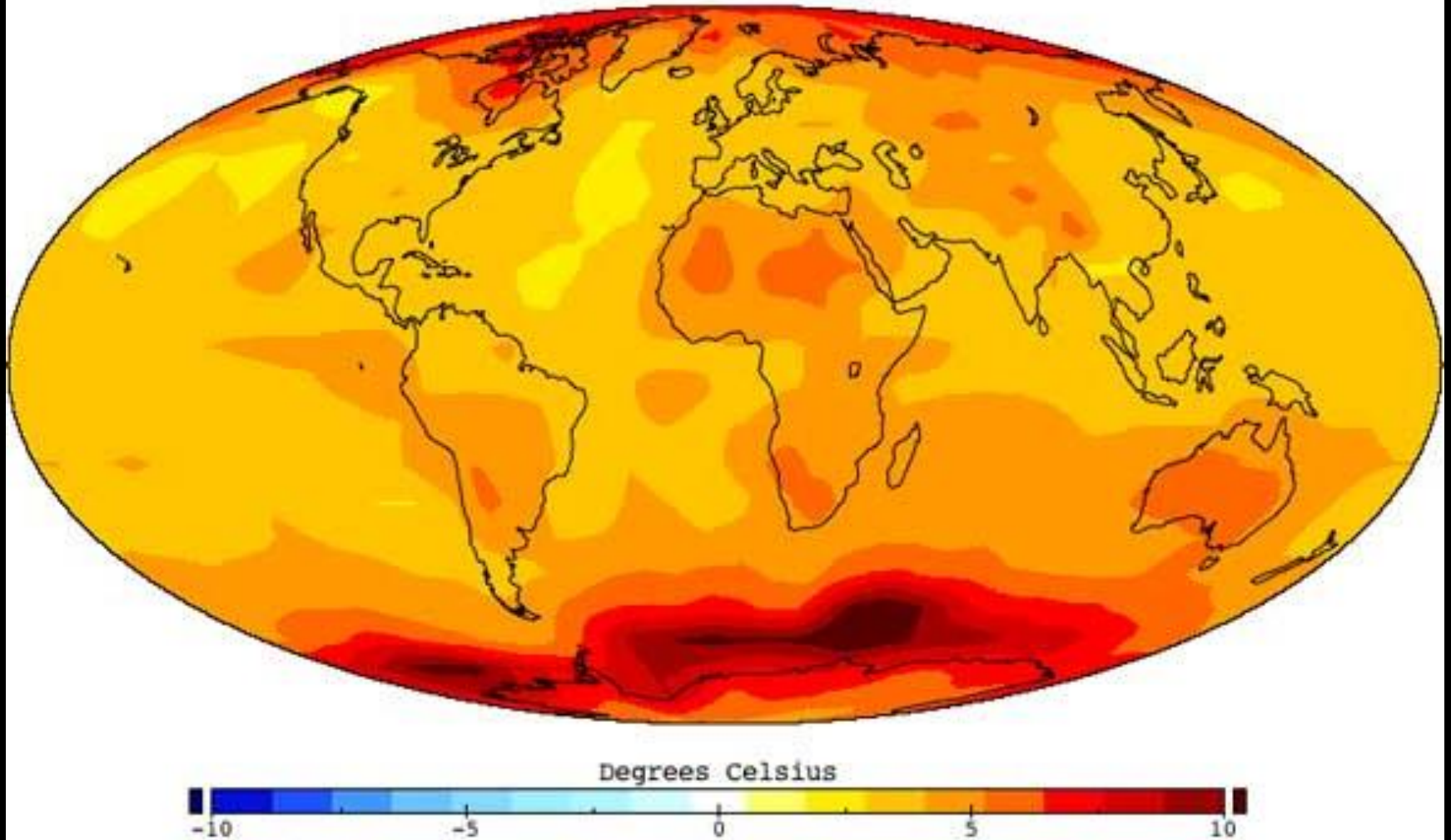
[Speaker notes]

...of scenarios and theoretical models.





## Surface Air Temperature Increase 1960 to 2060



Mollweide projection centered on 0.0°E

Data Min = 1.94423, Max = 11.38604



[Speaker notes]

But in recent years, as the impacts of climate change have become more evident....



Photo - John McColgan BLM Alaska Fire Se



[Speaker notes]

...and hit closer to home, it has become clear that climate change is not just a natural resource issue, but something we are all going to have to address.







[Speaker notes]

Cultural landscapes throughout the National Park Service are vulnerable to the impacts of climate change. Severe storms...







[Speaker notes]

...floods and landslides...







[Speaker notes]

...rising sea level...







[Speaker notes]

...drought...







[Speaker notes]

...fire...







[Speaker notes]

...invasive species...







[Speaker notes]

...pests and disease – all threaten our historic resources.

Meanwhile, the way we manage and maintain our cultural landscapes may directly contribute to the progression of global warming.









[Speaker notes]

Energy consumption...





[Speaker notes]

...greenhouse gas emissions...







[Speaker notes]

...water consumption...







[Speaker notes]

...and the use of chemical pesticides,  
herbicides, and fertilizers.





[Speaker notes]

In 2010, the National Park Service formalized its response to climate change in its Climate Change Response Strategy.

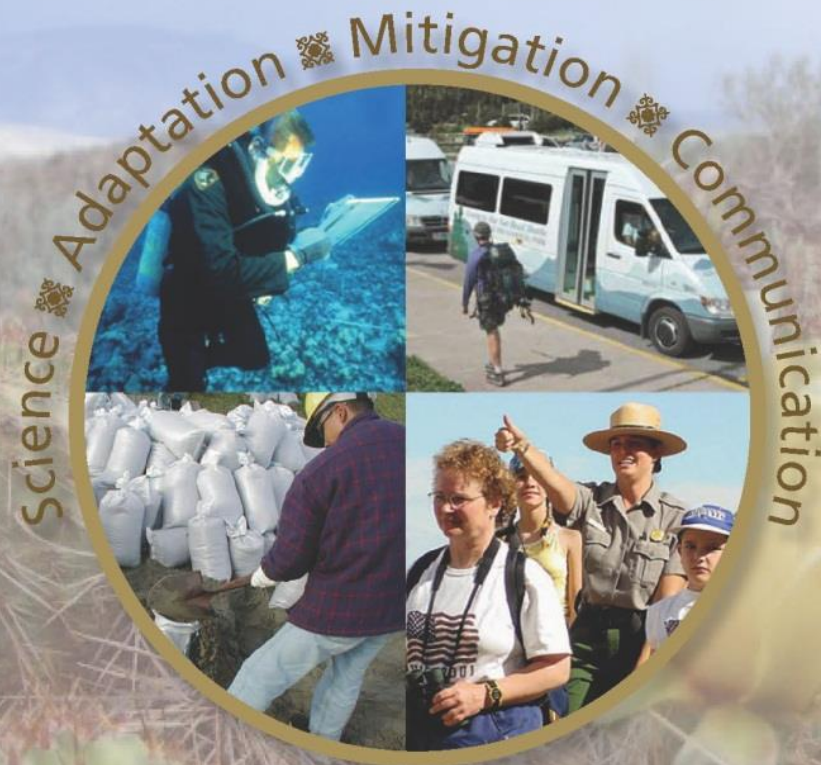
The strategy has four components:





# National Park Service Climate Change Response Strategy

September 2010





[Speaker notes]

# SCIENCE



**Science**





[Speaker notes]

# ADAPTATION



**Science**



**Adaptation**



[Speaker notes]

# MITIGATION





**Science**



**Mitigation**



**Adaptation**



[Speaker notes]

# and COMMUNICATION





**Science**



**Mitigation**



**Adaptation**



**Communication**





[Speaker notes]

and  
COMMUNICATION



## [Speaker notes]

These four components provide a helpful framework for discussing our challenges and responsibilities as cultural landscape managers in responding to climate change.

Today, I'd like to talk to you about how we as stewards of cultural landscapes can address climate change:

- to help better understand its impacts,
- slow its progression,
- and prepare for a changing future.

The presentation is divided into the four strategy components, with real world examples of how these components might apply to what we do as cultural landscape managers.



**Science**

Adaptation

Mitigation

Communication

## **Knowledge on which actions are based**

### **Goal 1**

*Use the best available scientific data and knowledge to inform decision making about climate change.*

### **Goal 3**

*Inventory and monitor key attributes of the natural systems, cultural resources, and visitor experiences likely to be affected by climate change.*







## [Speaker notes]

Science here obviously refers to the data collected by climate scientists, biologists, ecologists, and so on. But in more general terms, it refers to the collective body of information that might be relevant to climate change and how it affects our resources.

I've include here a few of the goals from the Climate Change Response Strategy that are most applicable to what we do. In the course of our work, we must be committed to utilizing the best available information about climate change to inform our management practices. This can include historical research, existing conditions analysis, *and* information about the relevant natural systems.

We also have the opportunity to contribute to the knowledge base through our processes of documentation, analysis, and monitoring of cultural landscapes.



**Science**

Adaptation

Mitigation

Communication

## Historical and existing conditions research

- Historic conditions documentation
- Change in the landscape over time
- Existing or potential impacts to the landscape





[Speaker notes]

In the course of the work we do, we pull together great amounts of information about the landscape and how it has changed over time.

This includes photos, aerials, historic maps, correspondence, and contemporary descriptions.



**Science**

Adaptation

Mitigation

Communication

## **Natural systems research**

- Climate change data and projections
- Endangered species
- Invasive species
- Hydrology/water quality







[Speaker notes]

We combine these with existing conditions analysis and natural systems data to synthesize a cohesive narrative of change in the landscape over time.



Science

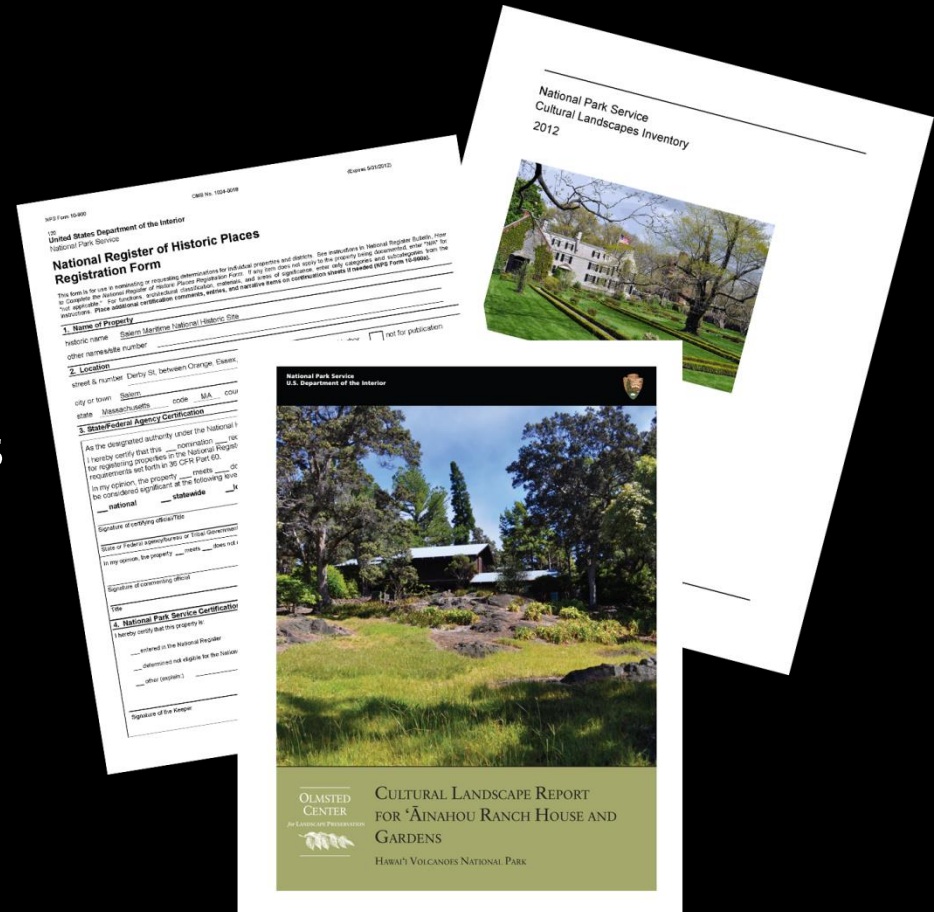
Adaptation

Mitigation

Communication

## Cultural landscapes documents

- Documentation
  - National Register Nominations
  - Cultural Landscapes Inventory
  - Cultural Landscape Reports
- Monitoring
- Evaluation of Knowledge Base





[Speaker notes]

These narratives, and the data that support them,  
are captured in the documents we produce,  
including CLR's, CLIs, and National Register  
Nominations.



Science

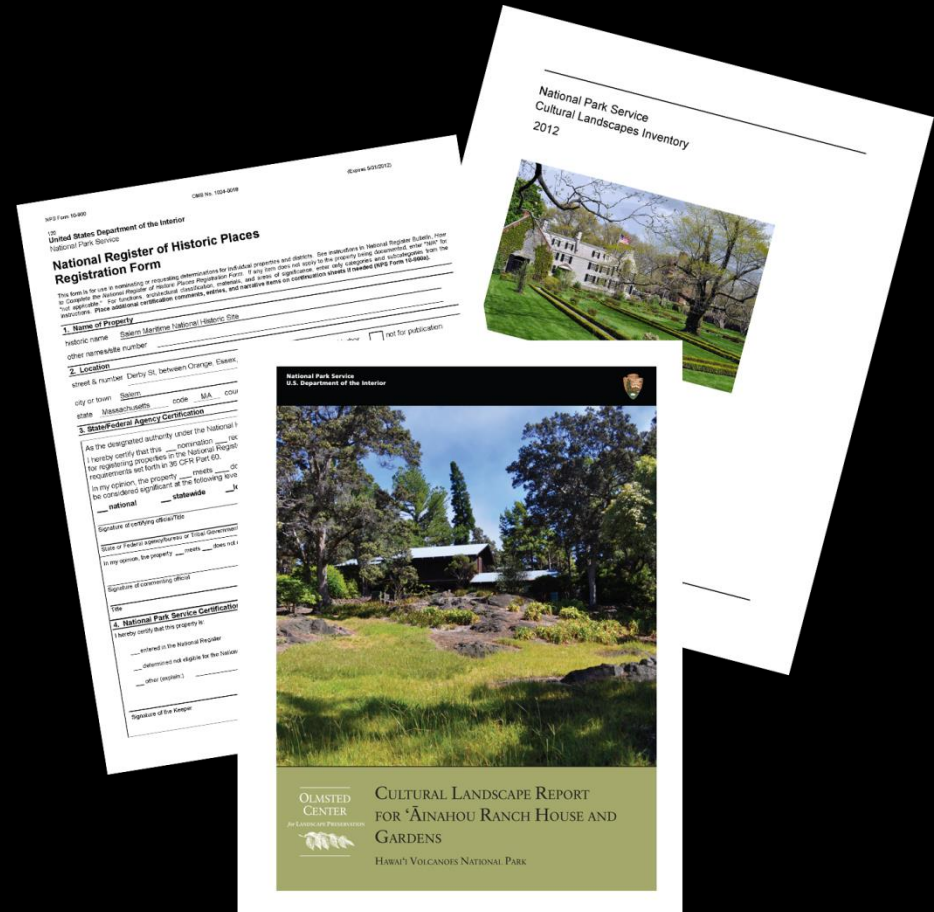
Adaptation

Mitigation

Communication

## Cultural landscapes documents

- Documentation
- Monitoring
  - Condition Assessments
  - Record of Treatment
  - Section 106 Process
- Evaluation of Knowledge Base







[Speaker notes]

We are able to monitor ongoing changes  
through CLI condition updates and records of  
treatment...



**Science**

Adaptation

Mitigation

Communication

## Cultural landscapes documents

- Documentation
- Monitoring
- Evaluation of Knowledge Base
  - Foundation Documents
  - State of the Parks





[Speaker notes]

And we regularly assess the state of our knowledge base to ensure that the resources are being adequately documented.

**Science**

Adaptation

Mitigation

Communication



Big Hole National Battlefield





[Speaker notes]

Our research often allows us to monitor large-scale changes in the landscape, highlighting changes in vegetation patterns, forest cover, rainfall, and topographical features.

At Big Hole National Battlefield, documentation allows us to monitor the forest encroachment on the historically clear hillside.



**Science**

Adaptation

Mitigation

Communication



Big Meadows, Shenandoah NP



[Speaker notes]

At Big Meadows in Shenandoah National Park,  
historic aerial photos from as recently as the 1950s  
show significant reduction in the meadow size.





**Science**

Adaptation

Mitigation

Communication



Bloom timing at Saint Gaudens NHS





[Speaker notes]

At Saint Gaudens NHS, monitoring  
blooming times of the apple trees can give  
information about how the timing of the  
arrival of spring has changed since historic  
times.



**Science**

Adaptation

Mitigation

Communication

Phenology at Boston Harbor Islands  
NRA





[Speaker notes]

And at Boston Harbor Islands NRA, an intern undertook a phonological study that established a baseline of data for the leafing times of staghorn sumac.



## Science

## Adaptation

## Mitigation

## Communication

### Key contributions

- Document change in the landscape
- Identify Vulnerable Cultural Resources
- Identify Sensitive Natural Systems
- Articulate Historic Character
- Inform Treatment and Maintenance







[Speaker notes]

As we undertake cultural landscape research in support of our work, our key contributions to managing for climate change are to document change in the landscape, identify vulnerable cultural resources, identify sensitive natural systems, articulate historic character, and inform treatment and maintenance decisions.



Science

**Adaptation**

Mitigation

Communication

## **Adapting to a changing climate**

### **Goal 6**

*Implement adaptation strategies that promote ecosystem resilience and enhance restoration, conservation, and preservation of park resources.*

### **Goal 7**

*Develop, prioritize, and implement management strategies to preserve climate-sensitive cultural resources.*





[Speaker notes]

The climate is changing, and according to projections it will continue to change for the foreseeable future. Adaptation refers to the actions that are taken, and adjustments to practices, that accommodate the changing climate.

*In other words, how are we going to protect historic resources, preserve historic character, and protect the integrity of cultural landscapes against the impacts of climate change?*



Science

**Adaptation**

Mitigation

Communication

## Goals of adaptation in cultural landscape management

- Preserve integrity
- Avoid impairment
- Protect cultural resources
- Protect sensitive natural systems
- Build resiliency
- Manage with future conditions in mind







[Speaker notes]

As we adapt our management practices to account for climate change, our goals include:

- preserving historic integrity,
- avoiding impairment,
- protecting cultural and natural resources,
- building resiliency in the landscape, and
- preparing for future conditions.



Science

**Adaptation**

Mitigation

Communication

## **Adaptation measures**

- Compatible substitutions/alterations
- Physical protection
- Maintain, repair, replace
- Relocate
- Record and release





[Speaker notes]

Some measures we might take to adapt to the impacts of climate change include substituting or altering the components in the landscape in accordance with the Secretary's standards, physically protecting vulnerable resources, committing to on-going cycles of maintenance, repair and replacement, relocating resources under imminent threat, and - a last resort- recording and releasing the resources to succession.





Science

**Adaptation**

Mitigation

Communication

## **Preserve historic character (compatible substitution)**



Red pine stand at Val-Kill, Eleanor Roosevelt NHS





## [Speaker notes]

We often prescribe substitutions or alterations to the landscape to accommodate changing conditions.

Any changes should be compatible in character and preserve the historic integrity, but we often have to make compromises between historic accuracy and the realities of maintaining resources or keeping vegetation alive.

At Eleanor Roosevelt National Historic Site, a historic red pine stand has been struggling for some time, infested with the red pine scale. Rather than replace the stand with more red pines, which will likely continue to struggle, a substitute pine species will be chosen to replicate the historic character of the stand.



Science

**Adaptation**

Mitigation

Communication

## **Preserve historic character (compatible substitution)**



Rapidan Camp, Shenandoah NP





## [Speaker notes]

The solution at Rapidan Camp in Shenandoah National Park was not as clear. The death of nearly all of the eastern hemlock trees from the hemlock wooly adelgid in the late 1990s transformed the once shady glen into an open meadow colonized by brush and invasive species.

Since the adelgid is still an issue, the hemlocks can't be reinstated without extensive treatment with pesticides. When the options were weighed, and in consultation with park staff and forestry specialists, the likely recommendations are going to be to allow the native pioneering yellow poplar trees to grow into a canopy.

While the character of the deciduous poplars will certainly be different from the historic hemlock glen, it *will* create a shady, closed canopy of single-age trees, quickly and with minimal intervention.

Science

**Adaptation**

Mitigation

Communication

## **Protect vulnerable resources**



Riparian flood protection at Rapidan Camp, Shenandoah NP





[Speaker notes]

Steps must often be taken to physically protect resources from the impacts of climate change.

Heavy rains in the mountains around Rapidan Camp can cause rivers to flood, pushing down boulders, tree trunks, and debris that scours the river bed. Resources located near the river must be protected from damage.

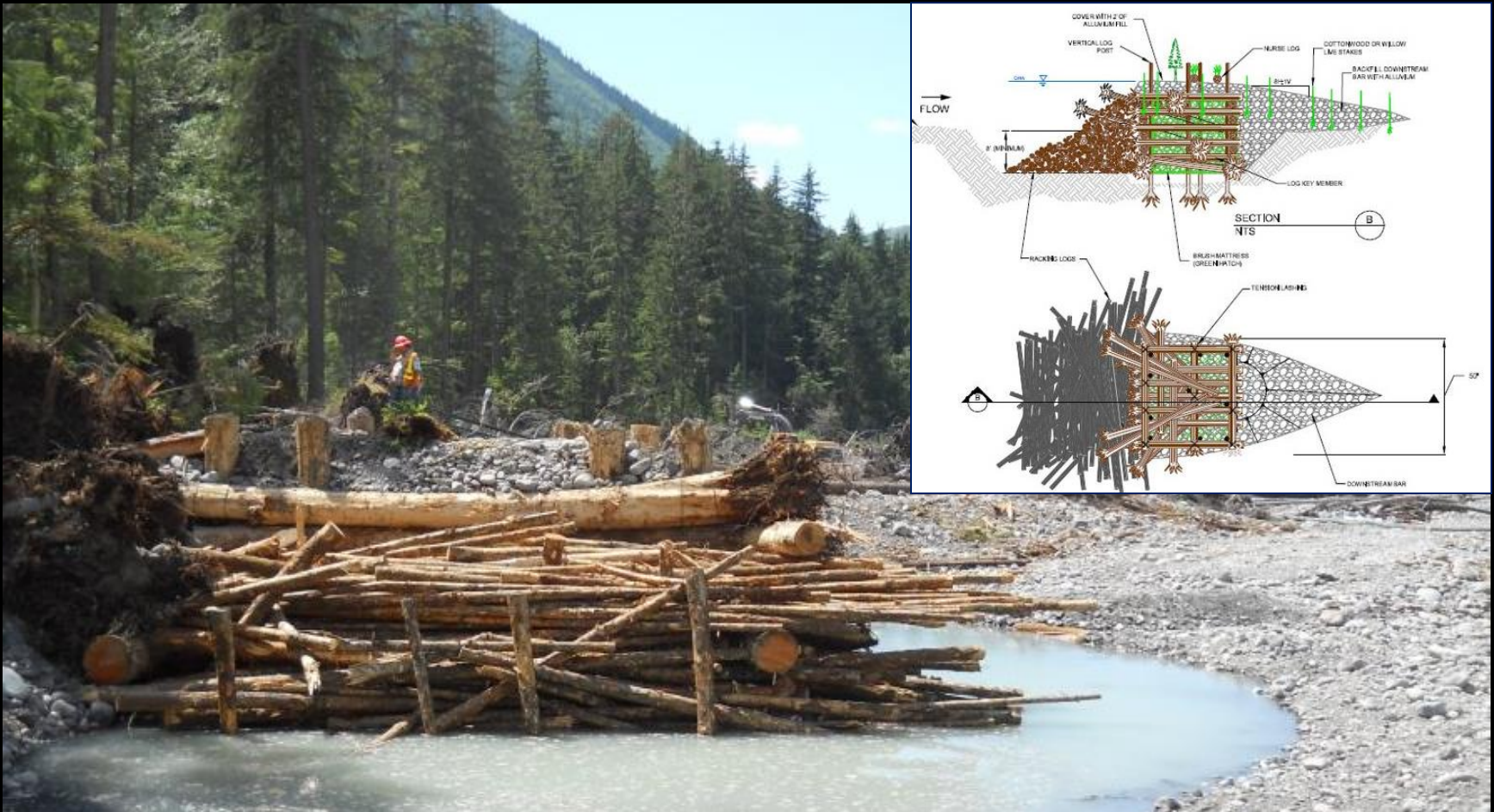
Science

**Adaptation**

Mitigation

Communication

## Protect vulnerable resources and build resilience



Historic road flood protection with engineered log jam at Mount Rainier NP



[Speaker notes]

Innovative flood protection can be effective at protecting cultural resources while preserving the natural and historic character of the views from the road.

At Mount Rainier National Park, engineered log jams absorb the energy from glacial lake outburst floods, protecting historic roads from damage.



Science

**Adaptation**

Mitigation

Communication

## Protect natural systems



Invasive barberry and English ivy at Vanderbilt Mansion NHS



[Speaker notes]

Cultural landscapes often contain vulnerable natural systems that could be affected by management actions. Treatment and maintenance recommendations must protect the historic character while protecting the natural systems.

At Vanderbilt Mansion National Historic Site, historic vegetation included highly invasive species like barberry and English ivy. Treatment recommendations specified non-invasive substitutions to prevent these from spreading into nearby forests.



Science

**Adaptation**

Mitigation

Communication

## Protect natural systems



Endangered nēnē at 'Āinahou Ranch, Hawai'i Volcanoes NP





[Speaker notes]

Endangered nēnē at ‘Āinahou Ranch in Hawai‘i  
Volcanoes NP use the landscape for breeding  
during the winter.

Mowing and other maintenance activities are  
scheduled and carried out so that they do not  
impact the nēnē.



Science

**Adaptation**

Mitigation

Communication

## **Build resiliency (compatible substitution)**



Drought tolerant native plantings at Upper Fort Mason, Golden Gate NRA



[Speaker notes]

By building resiliency in the landscape, it can better withstand adverse conditions. This might include selecting stronger materials, improving the health and vigor of the biotic systems, or replacing vulnerable vegetation with more resilient species.

The inclusion of non-historic native plantings can be used to create a desired character, while increasing the landscape's resiliency to adverse conditions. At Golden Gate National Recreation Area, drought-tolerant native plantings enhance the historic character while standing up to dry summers.





Science

**Adaptation**

Mitigation

Communication

## **Cyclical maintenance**

Maintaining historic pear trees at  
Manzanar NHS





[Speaker notes]

Preserving resources in the face of changing conditions often means recognizing that frequent and on-going maintenance, repair, and replacement are necessary.

Properly maintaining fruit trees improves their health and helps them withstand periods of drought and fend off diseases.



Science

**Adaptation**

Mitigation

Communication

## **Cyclical replacement**

Replacement of pear trees at John Muir  
NHS







[Speaker notes]

Historic vegetation, such as these pear trees at John Muir National Historic Site, may need periodic replacement.

Science

**Adaptation**

Mitigation

Communication

## Relocate Resources



Cape Hatteras Lighthouse, Cape Hatteras NS



[Speaker notes]

There are times when no amount of protection can ensure the survival of cultural resources.

In the case of high-value resources, these may be relocated away from the threat





Science

**Adaptation**

Mitigation

Communication

## Record and Release



Fish Ponds and seawall, Pu'uhonua O Hōnaunau



[Speaker notes]

And finally, some resources will not be able to be saved, and the only practical recourse will be to record them and let them go.





Science

Adaptation

**Mitigation**

Communication

## **Sustainable management to reduce impact on the environment.**

### **Goal 10**

*Integrate climate change mitigation into NPS business practices.*

### **Goal 11**

*Promote biological carbon sequestration as a function of healthy ecosystems.*







[Speaker notes]

While it is necessary to be prepared for a changing climate, we must also be doing all we can to reduce our contribution to global warming. Mitigation refers to actions that reduce gas emissions and energy and resource consumption, thus reducing our carbon footprint.

The Climate Change Response Strategy directs us to include climate change mitigation into all levels of NPS practices.



Science

Adaptation

**Mitigation**

Communication

---

- Use low-maintenance materials/ species
- Reduce energy consumption
- Reduce use of emitting equipment
- Conserve water
- Foster healthy landscape systems
- Sequester carbon on site





[Speaker notes]

As cultural landscape managers, we can reduce the impact to climate change by using environmentally friendly practices in landscape maintenance, reducing the level of maintenance required in the landscape, and building healthier, more self-sufficient systems in our historic landscapes.





Science

Adaptation

**Mitigation**

Communication

- Incorporate landscape maintenance into climate friendly action plans
- Consider carbon footprint in treatment recommendations





[Speaker notes]

Since landscape maintenance can be a significant source of a park's energy consumption and waste generation, it should be included in any discussions about a sustainable park operations.

And as landscape planners, we should be incorporating potential environmental impacts and their mitigation in our treatment recommendations.



Science

Adaptation

**Mitigation**

Communication

## Reducing mowing



Glenmont, Thomas Edison NHP in 1930s (left) and today (right)





[Speaker notes]

Mowing turf grass is a major source for landscape maintenance across the system and a significant source of greenhouse gas, as well as water usage, fertilizer, and herbicide. Solutions to reduce mowing can help parks move toward a lower carbon footprint.

Cultural landscape reports can help define character objectives and recommend mowing plans that reduce the area or frequency of mowing.



[Speaker notes]

At Thomas Edison NHP, what is today maintained as mowed turf grass was historically a meadow maintained by grazing livestock.

The treatment plan recommends conversion of a portion of the lawn to meadow, with an increase in the meadow species and a reduction in the frequency of mowing.

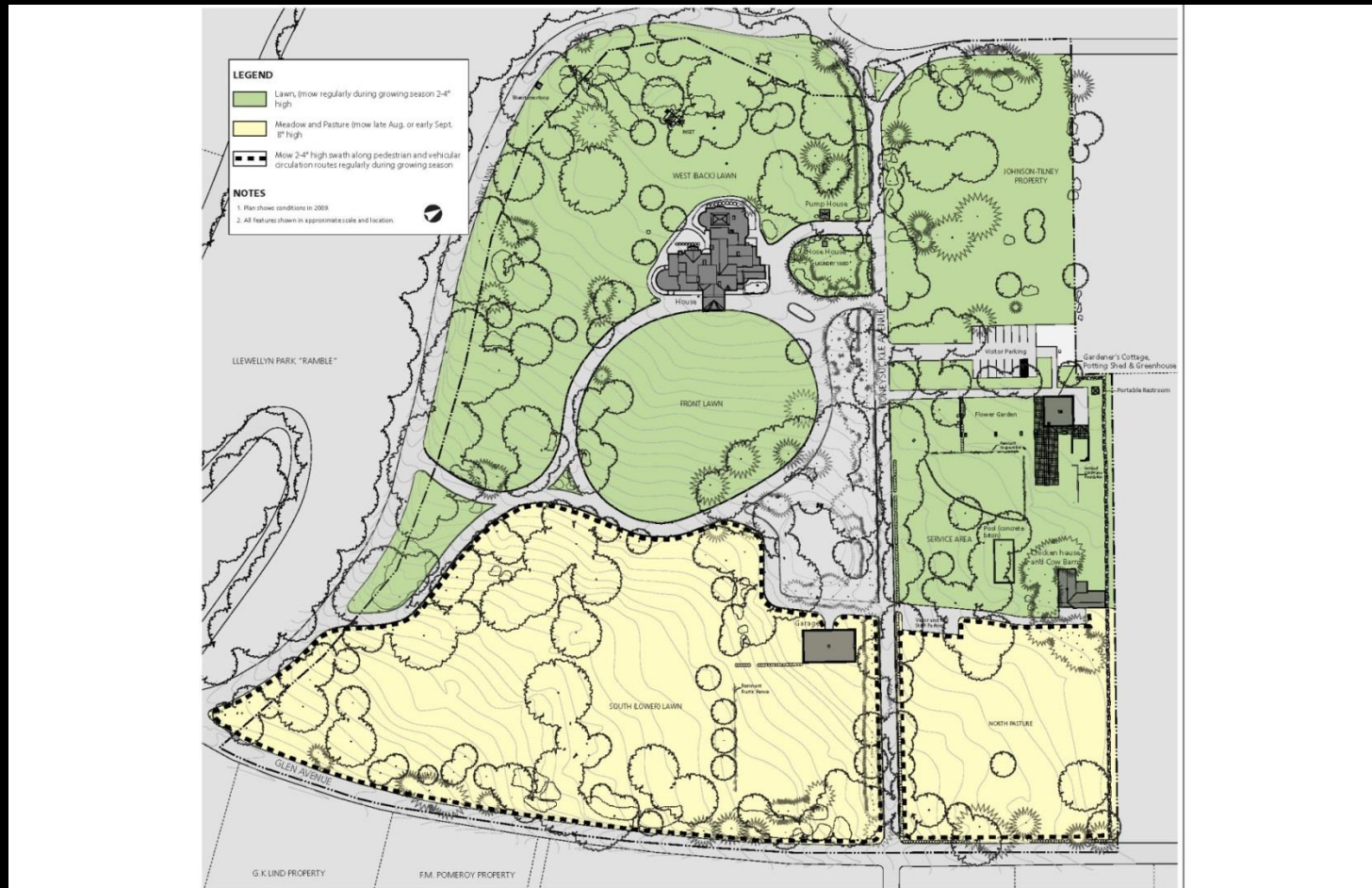
Science

Adaptation

**Mitigation**

Communication

## Reducing mowing



Mowing plan for Glenmont, Thomas Edison NHP





[Speaker notes]

The turf areas to be converted to meadow character recommended in the treatment plan would result in a substantial reduction of area to be mowed regularly.

Science

Adaptation

**Mitigation**

Communication

## Reducing mowing



Maintained turf grass (left) and taller grass in an orchard (right)



[Speaker notes]

The difference reduced mowing can make,  
both in terms of reduced energy  
consumption, and in historic character, can  
be striking...





Science

Adaptation

**Mitigation**

Communication

## Reducing mowing



Meadows at Valley Forge NHP



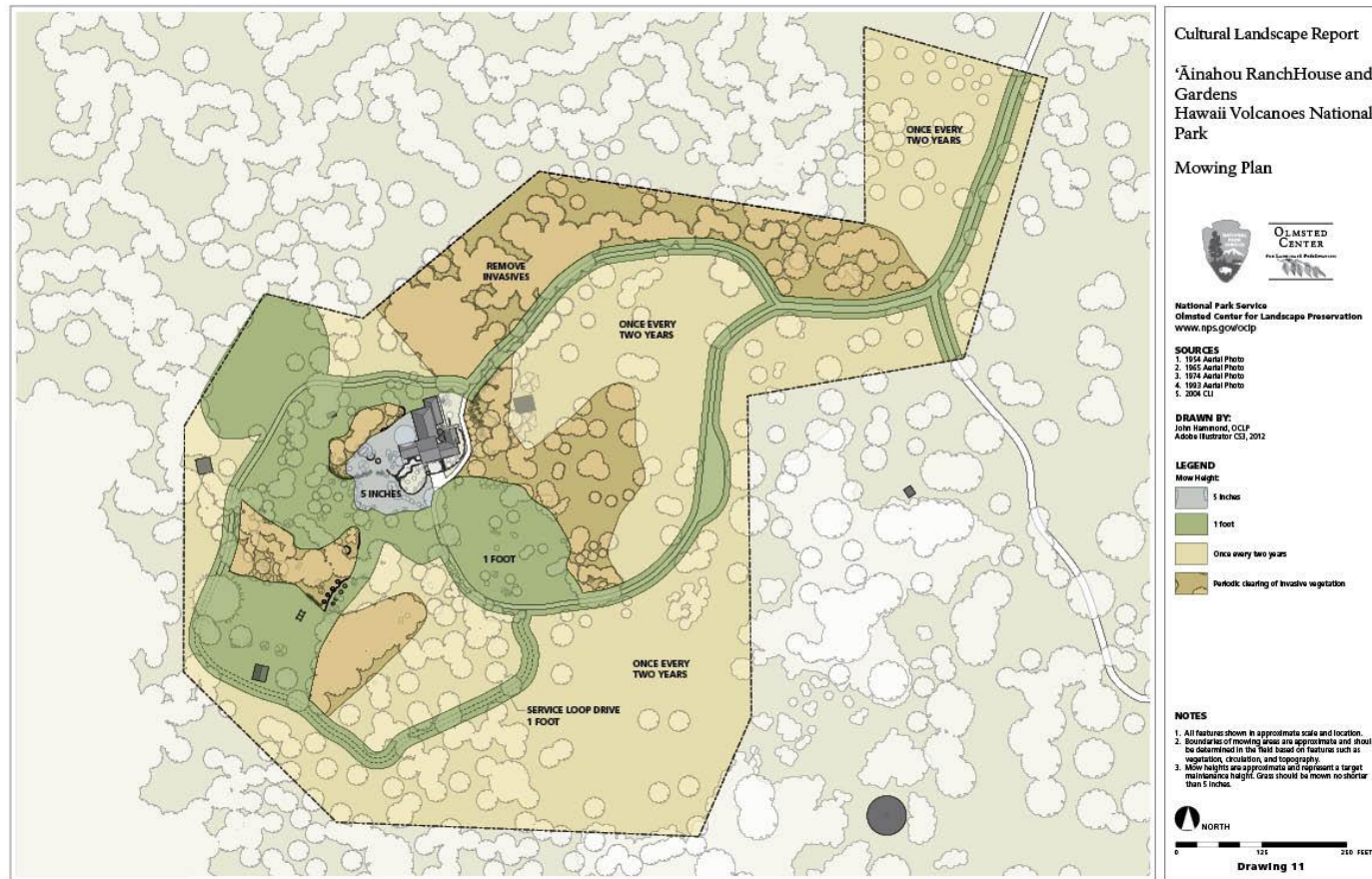
Science

Adaptation

**Mitigation**

Communication

## Focusing resources



'Āinahou Ranch: Hawai'i Volcanoes NP: Landscape Mowing Plan



[Speaker notes]

We can also reduce the amount of maintenance resources needed in the overall landscape by defining high-value areas where resources can be focused.





[Speaker notes]

At ‘Āinahou Ranch, maintenance resources were focused in the area around the house, where the garden had a highly ornamental, residential character.

Areas associated with views or circulation receive periodic mowing to keep grass moderately low, while other regions are mowed only as needed.

Science

Adaptation

**Mitigation**

Communication

## Focusing resources



Reduced mowing areas at Fort Baker, Golden Gate NRA



[Speaker notes]

A similar strategy at Fort Baker reduced the park's mowing burden by converting some turf areas to meadow character.



Science

Adaptation

**Mitigation**

Communication

## Compatible substitutions



Rose garden in the Formal Gardens at Vanderbilt Mansion NHS



[Speaker notes]

Substituting non-historic species or varieties that are better adapted to current conditions can reduce dependence on maintenance resources (water, pesticides, pruning, mowing, etc.).

Substitution of plant species rarely involves the removal of historic material, but rather supplementation of existing vegetation, reinstatement of vegetation that has been lost, or the replacement of non-historic vegetation.



[Speaker notes]

At Vanderbilt Mansion, a plant palette was developed for the formal garden to give the park and volunteers some flexibility in the bedding plants used.

Guidance was given regarding character, size, color, texture, etc., and sample lists of plants were provided.



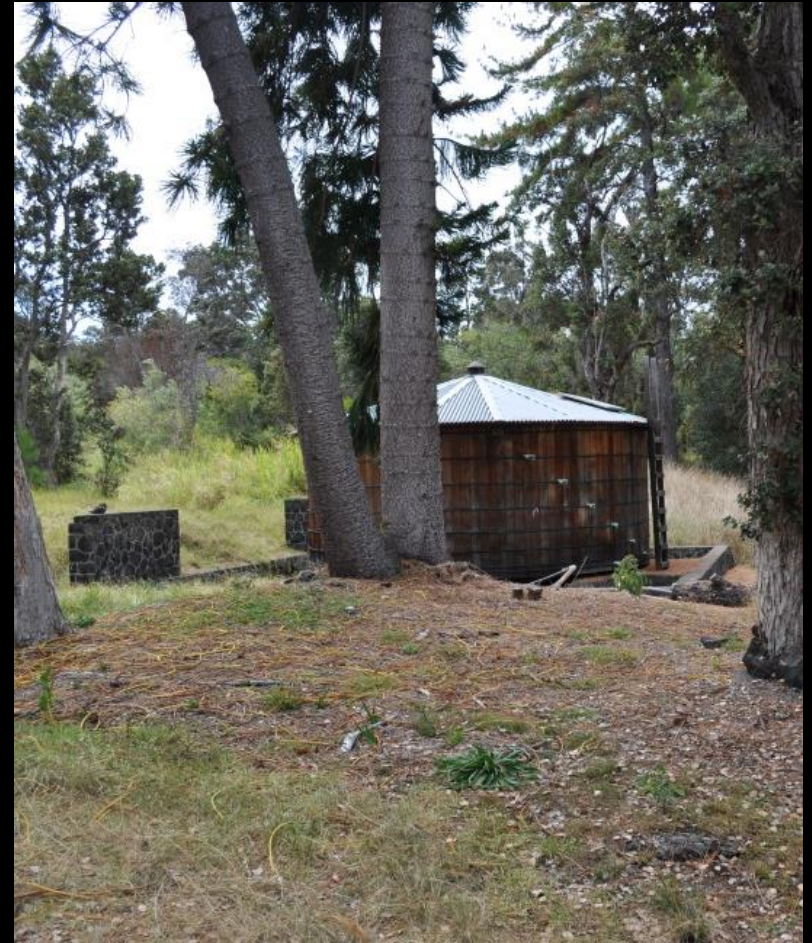
Science

Adaptation

**Mitigation**

Communication

## Historic landscape practices



Water catchment and storage system at 'Āinahou Ranch, Hawai'i Volcanoes NP



[Speaker notes]

Sometimes historic landscape practices can be revived or modified to meet current needs and reduce resource use.

This can have a combined advantage of enhancing historic character through land use, employing sustainable practices, and providing an opportunity for interpretation.



Science

Adaptation

**Mitigation**

Communication

---

## Conserving water



Drip irrigation in a historic orchard at Manzanar NHS





[Speaker notes]

Water-wise irrigation practices can provide needed water to historic vegetation while minimizing the overall consumption of water. Measures include the use of drip irrigation, use of solar pumps and controllers, irrigating at night, and irrigating only when needed.

Science

Adaptation

**Mitigation**

Communication

## Conserving water



Shredded bark mulch over driplines at Manzanar NHS



[Speaker notes]

The use of mulch reduces water consumption by reducing evaporation. The choice of mulch materials should include functional considerations as well as historic character.

At Manzanar, the mulch needed to be larger particles of chipped wood to withstand the frequent high winds.



Science

Adaptation

**Mitigation**

Communication

## Utilizing alternative fuels



Propane retrofitted mower at San Antonio Missions NHP



[Speaker notes]

Emissions can be reduced by purchasing or retrofitting equipment to run on alternative fuels, such as propane gas, biofuels, and electricity.



Science

Adaptation

**Mitigation**

Communication

## Reduce use of herbicides, pesticides and fertilizers



*Herbicide salt crystals on brick sample (NCPTT)*







[Speaker notes]

Chemical applications of herbicides, pesticides, and fertilizers have a number of disadvantages, both to natural and cultural resources.

In addition to the petroleum used to manufacture and transport them and the pollution to storm runoff, these chemicals can damage historic materials.

Science

Adaptation

**Mitigation**

Communication

## **Reduce use of herbicides, pesticides and fertilizers**



Hand-pulling, black plastic, and steam weed removal



[Speaker notes]

Alternative methods for weed removal can be effective without the use of chemicals.





Science

Adaptation

**Mitigation**

Communication

## **Build landscape resiliency**

- improve biotic conditions for plant health
- Improve ability to adapt to change
- Improve soil biological activity
  - Increase organic matter
  - Stimulate microbiological activity
  - Improve root health
    - Aerate
    - Add organic matter
- Prune to remove dead and diseased tissue
- Substitute non-adapted species where possible





[Speaker notes]

Building resiliency in the landscape can help it resist the impacts of climate change, but it can also reduce the need to input resources.



[Speaker notes]

When the landscape is composed of healthier, more balanced systems, it is more self-sustaining and requires less maintenance. This includes improving soil health, increasing organic matter and natural nutrients, encouraging healthy root systems, and maintaining vigorous, disease-free plants and trees.





Science

Adaptation

**Mitigation**

Communication

## **Build landscape resiliency**



Compost generated from park organic debris Marsh Billings Rockefeller NHP



[Speaker notes]

Composting landscape waste and applying it in the landscape returns nutrients to the soil, reduces the use of chemical fertilizers and other treatments, reduces exported waste, and sequesters carbon on site



Science

Adaptation

**Mitigation**

Communication

## **Build landscape resiliency**



Nutritional mulch of shredded bark and compost provides organic nutrients at San Juan Island NHP





[Speaker notes]

Nutritional mulch composed of composted materials reduce water loss and returns nutrients to the soil.



Science

Adaptation

**Mitigation**

Communication

## **Build landscape resiliency**

Improve the overall health of the landscape and reduce the energy required to maintain it.



Heritage Oak, Fort Vancouver NHS



[Speaker notes]

By taking a holistic approach to cultural landscape management, we can make our landscapes healthier, more balanced, and more resilient to the impacts of a changing environment.

Vital, balanced systems are better able to withstand and compete with pests, diseases, drought, invasive vegetation, and high winds. When we make our landscapes healthy, they are better able to fight their own battles.





Science

Adaptation

Mitigation

**Communication**

## **Spreading the message and leading by example.**

### **Goal 13**

*Increase climate change knowledge and understanding within the National Park Service.*

### **Goal 14**

*Provide external communications about the implications of climate change and the National Park Service response*

### **Goal 15**

*Model and communicate sustainable practices that lead by example.*





[Speaker notes]

As scholars and stewards of the landscape, our expertise spans the fields of history, horticulture, ecology, biology, and geography. This unique position allows us to connect physical changes in the landscape to the story of how people have interacted with their environment.

It allows us to make climate change, among other factors, more visible in the landscape.



Science

Adaptation

Mitigation

**Communication**

## Communicating climate change *within* the NPS

- Demonstrate holistic approach
- Establish baseline information
- Provide information to resource managers and interpreters
- Engage multiple disciplines in cultural landscape management







[Speaker notes]

Sharing our expertise with our colleagues within the park service increases the knowledge base, fosters stewardship, and allows park managers to make informed decisions about how their cultural landscapes are managed.



Science

Adaptation

Mitigation

**Communication**

## Communicating climate change *beyond* the NPS

- Connect the human story with the environmental story
- Highlight human interaction with the natural environment
- Demonstrate traditional practices and relationship with the landscape
- Make green practices visible
- Lead by example





[Speaker notes]

And communicating our efforts with visitors, neighbors, and partners brings relevance and immediacy to climate change and its impacts, and demonstrates practices that can reduce our carbon footprint.





Science

Adaptation

Mitigation

**Communication**

## **Incorporate the landscape story into interpretive programs**

Tell the stories of human adaptation and response to their environment





[Speaker notes]

By incorporating the landscape story into interpretive programs and materials, we impart to our visitors the potential impacts of climate change, the benefits of treating our landscapes ecologically, and the power of traditional practices in maintaining healthy, balanced ecosystems.



Science

Adaptation

Mitigation

**Communication**

## **Lead by example**



Turf grass test plots at Fort Baker, Golden Gate NRA





[Speaker notes]

And by making our efforts  
visible...



Science

Adaptation

Mitigation

**Communication**

## **Lead by example**



Turf grass test plots at Fort Baker, Golden Gate NRA



[Speaker notes]

...and leading by example,  
we can have an impact that extends far  
beyond our park boundaries.

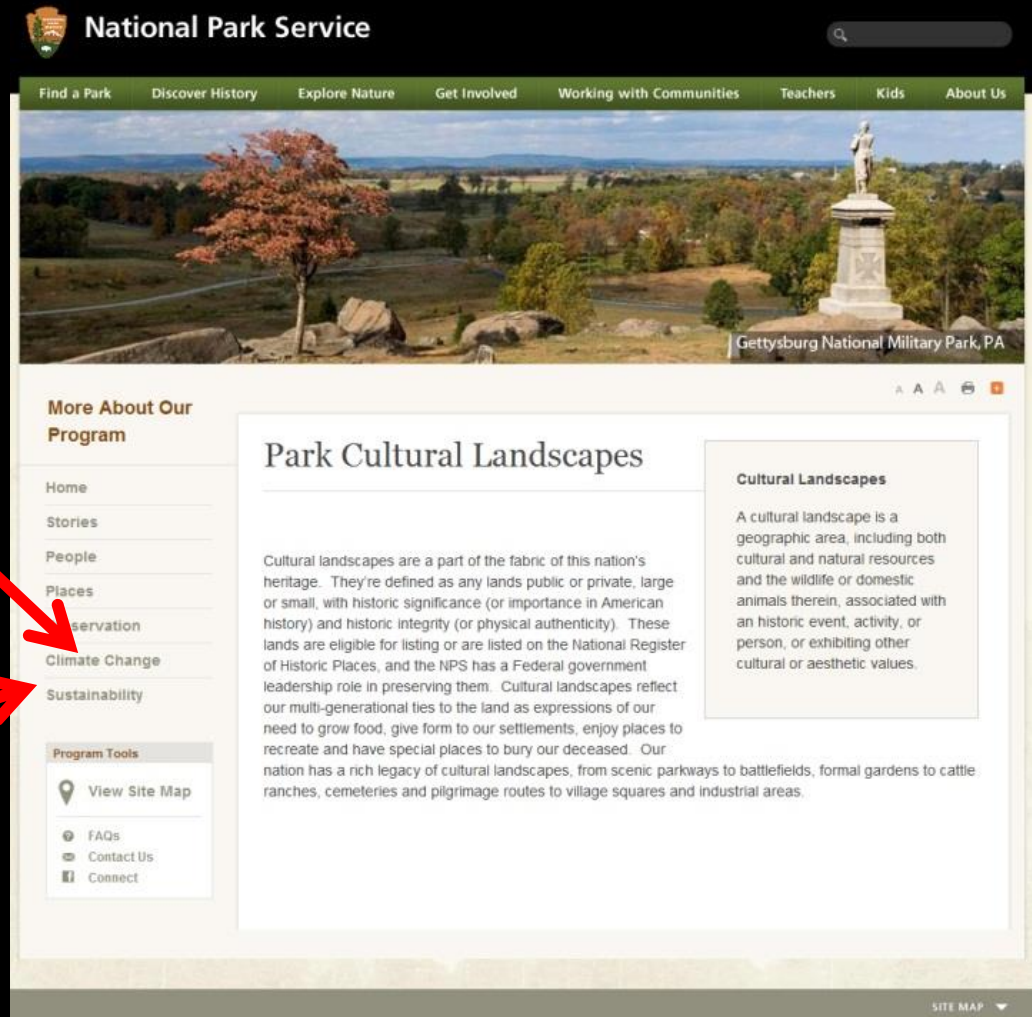




For more information: [http://www.nps.gov/cultural\\_landscapes](http://www.nps.gov/cultural_landscapes)  
also: <http://www.facebook.com/NPSCLP>

Climate Change and  
Cultural Landscapes  
page

Sustainability and  
Cultural Landscapes  
page





[Speaker notes]

Thank You.

From a presentation created by  
John Hammond, NPS Historical Landscape Architect